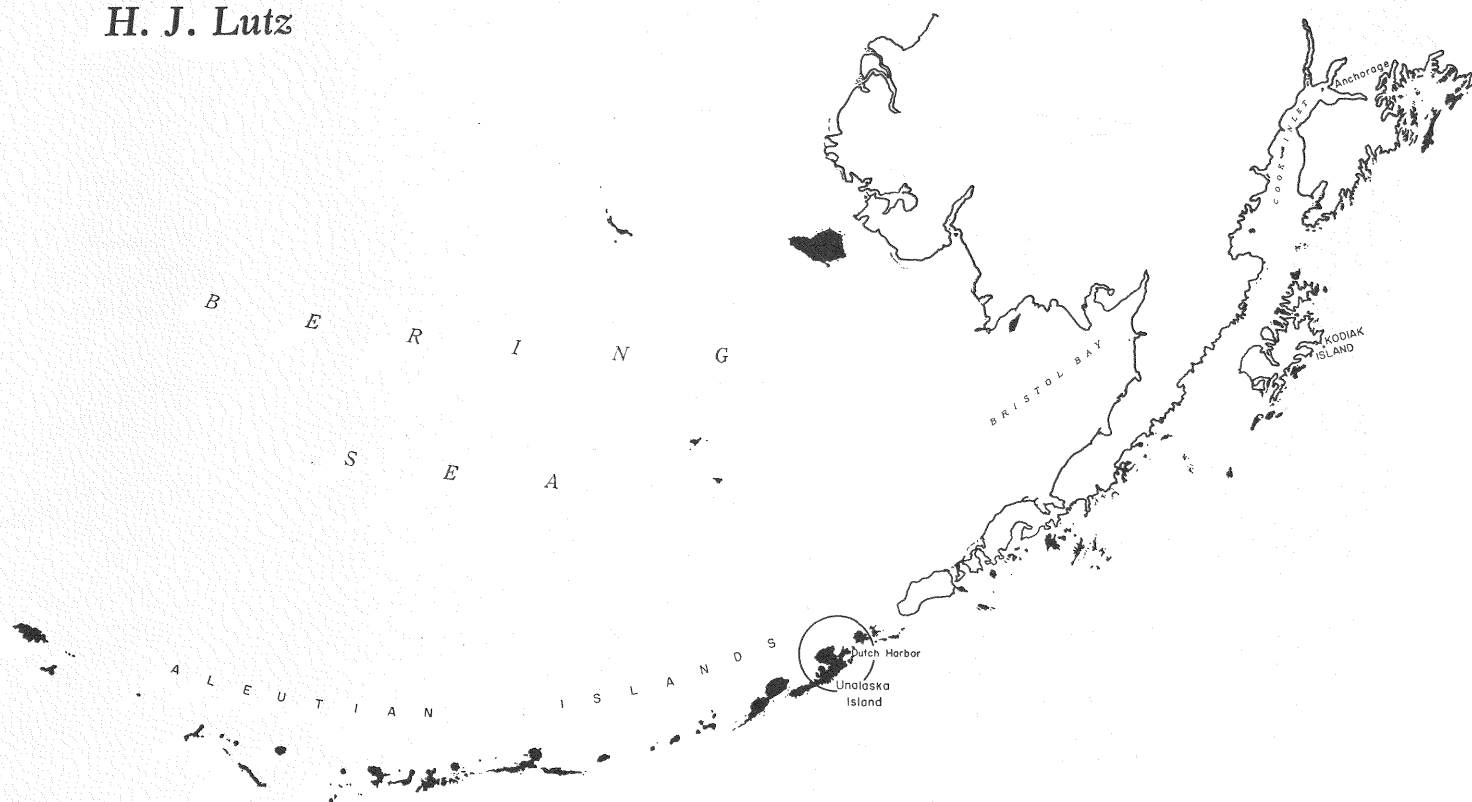


Sitka Spruce Planted in 1805

at Unalaska Island by the Russians

by

H. J. Lutz



NORTHERN FOREST EXPERIMENT STATION
FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE
JUNEAU • ALASKA

MAY • 1963

HISTORY OF SITKA SPRUCE PLANTED IN 1805 AT UNALASKA ISLAND,
ALASKA, BY THE RUSSIANS

by H. J. Lutz ^{1/}

Over 150 years ago a number of Sitka spruce ^{2/} trees were planted by the Russians on naturally treeless Unalaska Island. This was perhaps the first attempt at afforestation on the North American continent. All the Aleutian Islands are treeless; the western limit of natural tree growth on the Alaska Peninsula occurs roughly between Naknek Lake and Becharof Lake at the base of the peninsula. Griggs (1934) ^{3/} placed the westernmost occurrence of native Sitka spruce at Cape Kubugakli, which is the south point of entrance to Katmai Bay, Shelikof Strait, Alaska Peninsula. This is about 500 miles northeast of Unalaska Island.

Unalaska Island is in the eastern part of the Aleutian chain between longitude 166° and 168° west, and between latitude 53° 15' and 54° north. The planting in 1805 was on Amaknak Island in Captain's Harbor on the northeast side of Unalaska Island. The position of Amaknak Island is about 53° 53' north latitude and 166° 32' west longitude.

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^{2/} Picea sitchensis (Bong.) Carr.

^{3/} Names and dates in parentheses refer to Literature Cited, p. 20.

NATURAL FOREST GROWTH LACKING ON UNALASKA ISLAND

The natural absence of trees on Unalaska Island and on the Aleutian Island chain to the westward was a striking feature repeatedly recorded by early travelers in the region. The first person to observe and record the treelessness of the Aleutian Islands and to comment on why trees were absent was Georg Wilhelm Steller, natural scientist with Bering on his voyage of discovery in 1741 (Golder 1925). Steller, (pp. 81-84), recognized that many of the islands are relatively long and narrow with their long axis roughly following an east-west direction. He suggested that, as a consequence, the islands were exposed to rapid changes of heat and cold from southerly and northerly winds. He also suggested that, because of this slight breadth, the islands were swept freely by the severe storms of the region, making tree and shrub growth difficult.

Grigori Schelechof made two journeys to the northwest coast of America between 1783 and 1789, landing on Unalaska Island July 13, 1783. The account of his travels, published in 1793, includes (p. 6) observations on the vegetation of the Aleutian Islands, including Unalaska. Schelechof recorded that tall-growing wood was completely lacking but in some situations there occurred willow, alder, and mountain ash.

During the period 1785 to 1794, Joseph Billings engaged in a geographical and astronomical expedition for the Russian government. The narrative of this journey was prepared by Martin Sauer, secretary to the expedition, and was published in 1802. The expedition visited Unalaska Island in April 1792. Sauer reported (p. 266) that: "The other productions of the island are, the ground willow, already described (but not a single tree of any denomination whatever, nor does any of the islands west of Kadiak produce a tree of any kind: this I can positively assert);...."

After a visit to Unalaska in 1805, von Langsdorff (1814, p. 31) wrote: "No kind of trees grow either on this or the neighboring islands, only low bushes and shrubs of dwarf-birch, willow, and alder, with several sorts of berries, as rubus, vaccinium, rhododendron, and others."

In subsequent years many other travelers visited Unalaska and commented on the absence of trees. Their accounts confirm the observations cited above.

HISTORY OF SITKA SPRUCE PLANTED IN 1805

The first reference to the Sitka spruce planted at Unalaska seems to be that of Adelbert von Chamisso, the naturalist who accompanied the expedition of Otto von Kotsebu undertaken in 1815-1818. In the account of Kotsebu's voyage, published in 1821, von Chamisso (p. 287) wrote: "Oonalashka, and other islands of the chain, are entirely destitute of them [trees]. It has been attempted to plant pines, a kind of Abies, brought from Sitka, at Oonalashka; most of them have perished, the others seem scarcely to thrive, but the plantation is still young, and it is well known how ill coniferous trees bear transplanting." Evidently von Chamisso saw the plantation at Unalaska 10 to 13 years after it had been established.

The only indication as to who caused the Sitka spruce trees to be planted at Unalaska appears to be that given by Lutké (1835). During the years 1826-1829 Lutké made a voyage around the world by order of Emperor Nicholas I of Russia. Writing of Unalaska, Lutké stated that the plantation "on a little island adjacent to Unalaska" was established by order of the Russian Chamberlain Rezánov. This same information, drawn from the Lutké account, appears in U. S. S. R. Morskoe Ministerstvo (1861, part 4, pages 170-171). Lutké reported that the plantation was growing well; at the time of his visit to Unalaska the trees had been planted 22 years.

Veniaminov (1840) was the first, so far as the present writer knows, to give the date of the planting; on p. 54 Veniaminov stated that it was "about 1805." Subsequently the 1805 date was repeated by various authors including Ritter (1862, p. 245); Dall (1870, p. 446); Fernow (1901, p. 245); Greely (1909, p. 232); Hultén (1937, p. 63); Walker (1943, p. 15); and Bruce and Court (1945, p. 422).

Veniaminov (1840) reported on the condition of the planted Sitka spruce trees in 1834, at which time they had been established 29 years. He stated that the trees used were seedlings 2-3 years of age brought to Unalaska from Sitka. In 1834 there were 24 living trees, some of which were more than 7 feet in height and with a circumference at the base of about 18 inches (about 5.7 inches in diameter). He remarked that the trees were growing beside a lake; this small body of water appears in all the earliest photographs of the plantation. In 1833, according to Veniaminov, cones appeared on several trees. He also noted that it was apparent from the branches that at first the trees grew more in diameter than in height; the lowest branches were very long and close together. He observed that during the 6 or 7 years preceding 1834, rate of height growth increased; the distance between branch whorls that appeared in the last 5 years was equal to the increase in height made during the first 10 or 12

years. Some of the trees grew very poorly and caused Veniaminov to comment as follows, translating freely: "It is noteworthy that some of these trees, all of which were planted at the same time, are so small and thin that they appear to have come out of the soil not more than 4 years ago; they also have only a few branches. Why have they grown so slowly?"

In 1841 there was published an article entitled, "On sowing and planting trees on Unalaska Island," in a Russian forestry journal. After a search extending over several years a typescript copy of this article was obtained from the U. S. S. R. This report, by an anonymous author, stated that Veniaminov expressed to O. B. Fisher, a member of the Russian Society for the Encouragement of Forestry, a desire to undertake cultivation of trees on Unalaska Island. In response to this interest of Veniaminov, Fisher prepared brief instructions on the cultivation of trees and these instructions constitute the article. Actually, this report has nothing to do with the first tree planting at Unalaska, appearing, as it did, 35 years later. It is quite likely, however, that Fisher's instructions guided Veniaminov in some of the tree planting that he carried out at Unalaska. It is also possible that the expression of Veniaminov's interest in tree planting recorded here, and elsewhere, has led to the opinion occasionally voiced that Veniaminov was responsible for the planting done in 1805. Actually, Veniaminov did not arrive at Unalaska until July 29, 1824 (Kashevaroff 1927).

In 1860 Captain-Lieutenant Golowin was commissioned to make an inspection trip to the Russian colonies in America. His report was published in the Morskoi Sbornik in 1862 and was reviewed by Ritter in the same year. According to Ritter, Golowin reported that an experiment in forestation had been undertaken in the Aleutians; he stated that around 1805 young firs (Tannen) had been brought from Kodiak but that they failed and, in 1860, not a single tree remained. On the basis of earlier, and also later, observations by credible witnesses it is evident that Golowin was in error on two points, (1) the trees came from Sitka, not Kodiak, and (2) the trees did not all die for some of them remain to this day.

Tikhmeniev (1863), in an historical sketch of the Russian-American Company and its operations, remarked on the Unalaska plantings. A free translation of Tikhmeniev's statement (p.305) follows: "Of several spruce trees, delivered to Unalaska from Sitka and planted in the vicinity of the village of Illiliuk [also spelled Iliuliuk, now Unalaska] only those survived which were planted on Amachnak Island." In a section entitled "Additions and emendations to Chapter 20" is a note referring to the above remarks on p.305. This note adds that "According to reports of people who were recently in the colonies, the trees planted on Unalaska Island in the vicinity of the village Illiliuk grow only in diameter and not the least in height."

Captain W. A. Howard, U. S. Revenue Steamer Lincoln, described conditions at Unalaska Island in an official report prepared in 1867. It was stated on p. 201 that "... a few pines (or spruce) have been transplanted from 'Kodiak' and notwithstanding they were planted in the best sheltered soil, they with difficulty maintain a sickly existence." (Howard 1868)

Davidson (1868) in a report relative to the coast, features, and resources of Alaska territory, wrote as follows (p. 247):

There are no trees of any size whatever upon any of the Aleutian islands. A few Sitka spruce brought to Unalaska bay, and planted upon an island in the western roadstead, or Captain's harbor, [⁴/₄] some thirty years since, are said not to have grown as many inches in that time; but it appears to me quite probable that if trees were placed in good situations at first, and properly attended to, they would succeed. This single and unsuccessful attempt well exemplifies the retarding effect which the single and sole aim of fur trading has had upon the development of the colony.

Identical statements appear in Davidson (1869a and 1869b).

In the Report of the Commissioner of Agriculture for 1868 there appears a section on agricultural resources of Alaska by Dall (1869). He wrote (p. 182):

There is no timber on any kind larger than a shrub on these islands [Aleutians], but there does not appear to be any good reason why trees, if properly planted and drained, should not flourish. A few spruces were, in 1805, transplanted from Sitka, or Kodiak, to Unalaska. They lived, but were not cared for, or the situation was unfavorable, as they have increased very little in size since that time, according to Chamisso.

It may be pointed out that, if Dall was familiar with the report of von Chamisso, he should have known that the naturalist specifically stated the trees came from Sitka. Further, the trees had been established only 10 to 13 years when seen by von Chamisso but they were 63 years old at the time Dall wrote. There is no evidence that Dall actually saw the trees planted in 1805.

⁴/₄ Sarytschew (1807) stated that Captain's Haven or Captain's Harbor received its name from Captain Lewaschew having wintered there with his ships in 1768-1769.

Charles Bryant, a special agent of the Treasury Department for Alaska, reported on the Unalaska plantings in 1870. He wrote, (p. 19):

The late Bishop Veniaminoff had twenty trees transplanted from Kodiak thirty years since [which would make the date 1840]. The few that remain alive have reached a growth of twenty inches in diameter, and twenty-five feet high. Cones are formed on them, but the seeds do not ripen. Their location was unfortunately chosen, being on a small island in the harbor by the side of a small stream fed from melting snow; their roots are surrounded by water scarcely above the freezing point until very late in the season. Had they been placed on the dry hill-side east of the village, where the advantage of shelter from the north winds and the benefit of the sun's rays would have been received, I have no doubt they would have already seeded the ground. It would now be well to have seed sent to all of the islands from Sitka, and scattered in favorable situations.

It appears that the trees referred to by Bryant were not planted by Veniaminov but were those planted on Amaknak Island in 1805 at the instigation of Rezánov. It seems unlikely that, in 30 years time, trees planted by Veniaminov would have attained diameters of 20 inches and heights of 25 feet. Some confusion is encountered in the writings on the Unalaska spruce because there were at least two plantings made, the first in 1805 (credited to the interest of Rezánov) and the second by Veniaminov some time after 1824. It appears that the planting done by Veniaminov was not on Amaknak Island but in the village of Iliuliuk (Unalaska). Since Veniaminov in his "Notes on the Unalaska District," written in 1834, did not mention any spruce planting on Unalaska other than that of 1805, it may be inferred that his own planting was done after 1834. In the publication setting forth the seeding and planting instructions of O. B. Fisher (Anon. 1841), it was stated that several trees that had been transplanted from Novo-Archangel'sk (Sitka) to Unalaska by the Most Reverend Innokentii had taken root satisfactorily. This evidence may more closely define the date of Veniaminov's planting to sometime between 1834 and 1841.

Dall (1870, p. 446) referred to the spruce at Unalaska as follows: "A few spruce were transplanted from Sitka in 1805 to Unalaska. Most of them lived, but were not cared for, and the situation was unfavorable, so at the time of Kotzebue's visit they had not increased in size, and were looking very poorly, according to Chamisso." This is essentially the same as the language used by Dall (1869) in his reference to the spruce at Unalaska.

Scammon (1870, p. 439) wrote that:

A few small firs, brought many years since to Ounalaska, by the Russian-American Company, were planted in a sheltered valley. They are of the scrubby species, so often met with in New England, growing in open land. It is supposed by many that the climate or soil is not suited to the growth of timber. Be that as it may, the trees here mentioned are as thrifty as those of the same kind growing in their native soil.

In his noteworthy "Report upon forestry," Hough (1878) included the following remarks about the spruce on Unalaska (p. 612):

About the beginning of the present century, a few Sitka spruces were planted on an island in Iliuliuk Harbor, Unalaska, and in seventy years have become nearly a foot in diameter. Some thirty years later, a few more were planted on another small island in the same harbor, but with poor success. With these feeble exceptions, there has been, it is believed, no attempt at planting in any part of Alaska.

The second planting, around 1835, was evidently on Expedition Island and was probably carried out by Veniaminov.

In 1881 John Muir was aboard the Revenue-Steamer Corwin on a cruise in Alaskan waters. A report of this cruise, published in 1883, contains the following statement by Muir (p. 48): "Not a single tree has yet been seen on any of the islands of the chain west of Kodiak, excepting a few spruces brought from Sitka and planted at Ounalaska by the Russians about fifty years ago. They are still alive in a dwarfed condition, having made scarce any appreciable growth since they were planted." One finds a similar statement in a later publication by the same author (Muir 1917). If Muir was writing of the spruce planted on Amaknak Island, and presumably he was, his date of planting "about fifty years ago," should have been "about seventy-five years ago."

Cantwell (1887), in a newspaper account, wrote:

The first thing which strikes the traveler as a peculiar characteristic of the Aleutian islands is the entire absence of trees. From the island of Atton [sic], the most western of the Aleutian group there is not a single sign of a tree, except for a few stunted and storm tossed cedars at Oonalaska, which were transplanted there in the early days of Russian ownership by some enthusiastic and sanguine settler, probably with the idea that from this small beginning a forest might result. How badly he was mistaken is too plainly shown by the lonely looking trees which remain to this day exactly the same in number as when put in the ground fifty years ago.

Isabel S. Shepard, whose husband was Captain of the U. S. Steamer Rush, operating in the Bering Sea, visited the plantation in 1889. She wrote (p. 109-110):

One day, while the Rush was away on one of her trips to the Seal Islands, Dr. C _____ proposed we should go to "The Forest".... We rowed across the harbor, landed, fastened our boat, and climbing a little elevation, what was my surprise to see a group of evergreens spreading their branches over a small area, carpeted with pine needles. How delightful to the eye seemed those lonely little trees. They were gnarled and stunted, but still trees, and growing, though slowly. They were planted some fifty or sixty years ago, but they do not spread. The cone does not arrive at perfection.... Near the trees there was a small lake....

From the description this plantation must have been the one on Amaknak Island.

Reclus (1890) noted the natural treelessness of the Aleutians and observed that the only tree growth one sees is the spruce planted on Amaknak Island and at Unalaska a short time after the beginning of the nineteenth century. He noted that these trees showed good growth but had not reproduced. It was the opinion of Reclus that if not protected by man the little woods of Amaknak and Unalaska would disappear in a short time.

Applegate (1893, p. 84), in his report on the Unalaska District at the 1890 census, made casual mention of the spruce at Unalaska, as follows: "No trees grow in the district, unless I except a stunted, willow-like shrub which flourishes in the valleys along the streams on the peninsula and islands, and one small grove of spruce trees planted at Unalaska in 1824." The date 1824 seems to be in error.

Fernow (1901) was evidently the first forester to see the Sitka spruce plantation on Unalaska Island. A member of the Harriman Alaska Expedition, Fernow visited Unalaska in the summer of 1899. His account is of particular interest (pp. 245-246):

That trees can at least exist farther west, on the Aleutian Islands, is proved by a few scattered spruces at Unalaska, planted by a Russian priest in the year 1805. One group of twelve and another of seven remain; the trees are short and slowly grown, to be sure, but vigorous and in good health, except where fire has damaged some of them. At the time of our visit the largest measured twenty-four inches, the smallest, six inches in diameter, while all were of the same height, twenty-five to thirty feet.... The trees had been fruiting heavily the year before, and two smaller ones at a distance were undoubtedly the result of an earlier seed year. Evidently the chances of natural propagation in competition with the heavy growth of grass and weeds, with a late spring, short summer, and cold winds are small, even if ample sources of seed supply were within reach.

In 1903 Bristow Adams published an article entitled "The Unalaska spruce plantation." Two photographs, one of which is reproduced here as figure 1, were included in this article. Adams wrote as follows:

Whatever may have been the prompting motive, however, it is nevertheless a fact that a tree-planting experiment was made on the Aleutian Islands as far back as 1805, and the evidence of that planting is there today. At that time Unalaska was a trading post and a mission station of the Russians. A priest of the Russian-Greek Church made a plantation of Sitka Spruce in a sheltered cove among the hills back of what is now Dutch Harbor. How many trees were originally planted is not known, but at the present time there are six or eight alive, dwarfed and knotted, but still unmistakably trees, and a proof that they can at least live farther west than Kadiak Island. What these trees might have done if they could have had the benefit of a little care and cultivation is a surmise, yet it is likely that they have done as well as they could under any conditions.

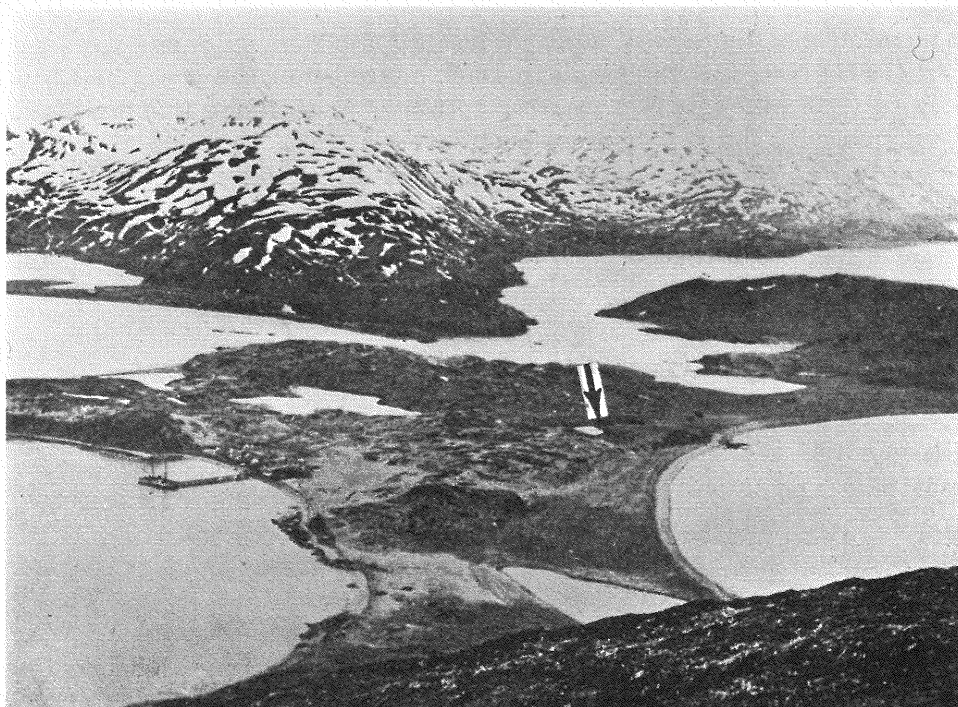


Figure 1.--Dutch Harbor and Unalaska. The arrow points to a small pond with trees planted near it. From Adams (1903).

The largest is about 25 feet high, or perhaps a little less, and the growth of all is unusually compact, like that of the ornamental Norway Spruce planted on open lawns, only more so. Their branches form a perfect mat, and a bird shot in the top of one would not fall to the ground. This was actually proved by members of the Harriman Expedition. None of the trees have ever been cut, so far as known, and there has been no reproduction. When seen by the writer there were no cones in evidence, though the cones of the Sitka Spruce at the extreme western limit of their range, on Kadiak, seem to be larger than those on the bigger trees of the mainland, where the species grows to its highest perfection.

Even here in fog and mist, these trees have suffered from the scourge of fire, for on one or two, the lower limbs, which lie close to the ground, have been burned to a man's height, presumably from a blaze in the "wild rye" grass, which has a rank growth in the cove where the plantation is found.

The trees stand today, the record of a century's battle with adverse conditions, 500 miles from their nearest kin, and they do not look as if they like it. In view of their testimony, it is quite apparent that no matter what the future of the peninsula and islands may be, it does not lie in the direction of forest production, and lumber will have to be imported as heretofore.

Adams stated that there was no reproduction and that no cones were evident; Fernow (1901), who saw the trees in 1899, stated that the trees had fruited heavily in 1898 and saw two smaller spruce at a distance that he thought were undoubtedly the result of an earlier seed year. Figure 2 is a photograph taken in 1899 and published by Cantwell in 1904.

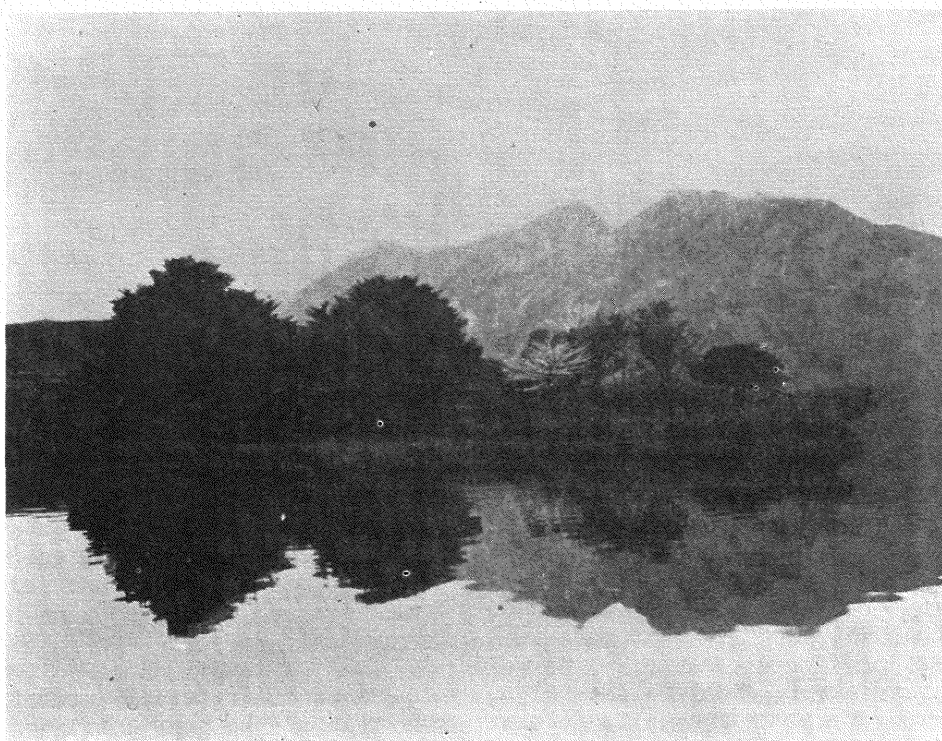


Figure 2.--Spruce "forest", Dutch Harbor, planted by the Russians at the time of their first occupation of the Territory. Photo taken in 1899. From Cantwell (1904).

Jaggar (1908) accompanied the Technology Expedition to the Aleutian Islands in 1907. He observed that at Unalaska, "There are no trees except a small clump of spruces planted by the Russians about 1840. These are flourishing, and show that trees would grow on the islands if once they were given a start."

Greely (1909, p. 232) wrote of the Aleutian Islands that "The whole group is treeless, except for a few stunted willows in sheltered ravines of the easterly and warmer islands. At Unalaska barely live a few spruces transplanted there in 1805."

Underwood (1913, p. 80), writing of Unalaska, noted that "A few stunted spruce trees which are said to have been planted by the Russian settlers, comprise the only growing timber on the island...."

In 1917 or 1918 Winchell (1951) visited the trees planted on Expedition Island, referring to them (pp. 86-87) as "... a group of scrubby ever-green trees...." She thought that "These were planted more than a hundred and thirty years ago in memory of some Russian priests who were killed."

In 1931, Tatewaki and Kobayashi investigated the flora of the Aleutian Islands. Among the plant communities they recognized was a "Society of Picea sitchensis," that they described in the following way (p. 15): "The societies of Picea sitchensis are found in the bog near Unalaska. Its stems attain a height of 7-8 m. [about 21-24 feet] and is the only tree found during our trip through the Islands." It may be noted in passing that Hultén (1937, p. 36) viewed the "societies" of Sitka spruce recognized by Tatewaki and Kobayashi as "... hardly compatible with the facts, as the one single Picea grove in the Islands consists of a few planted trees."

Hultén (1937, p. 63) referred to the Unalaska spruce as follows:

On Amuknak I. in Unalaska Harbour are found a few trees of this species [Picea sitchensis (Bong.) Carr.] together forming a small grove. Acc. to Veniaminov loc. cit. there were sent from Sitka 24 small plants which were planted at Unalaska about 1805. In 1834 some of them were 7 feet high and the stems had a circumference of 18 inches. In 1833 they produced cones for the first time. At the present time several of the trees are dead, but the rest produce cones with seeds that look normal. No young trees have grown up around the little grove. ...trees that were planted at the village in 1805 died. Later some trees of Sitka-spruce have been planted at Unalaska village and on Expedition Isl. in Unalaska harbour, but they are badly deformed by the wind. The trees on Amuknak I. are the westernmost in America.

In a discussion of forest trees at their northern limits, Tiulina (1937) barely mentions that "... the spruces, which were planted many years ago by Russians in the tundra at Unalaska continue to grow there to the present time."

Hutchinson (1942a, 1942b) figured a view of the spruce trees on Amaknak Island. She quoted from Hultén (1937) and observed that "The few [trees] now remaining are thick in girth, but no young trees have grown up around them."

Walker (1943, p. 15) observed that "No trees grow naturally on the Aleutians, but a clump of 13 spruces planted at Dutch Harbor in 1805 are now about 25 feet high." Dutch Harbor is on the eastern side of Amaknak Island, the site of the planting in 1805.

The anthropologist Hrdlička (1945, p. 16) wrote that "A number of Siberian spruce trees planted at Unalaska and on Amoknak Island in the early part of the nineteenth century by the Russians, survive for the most part to this day, but their growth has been greatly stunted--the soil probably lacks the right microorganisms, rather than, or besides, minerals, for such vegetation."

Egbert H. Walker prepared the section, "Plants of the Aleutian Islands," in the publication by Collins, Clark, and Walker (1945). Walker stated (p. 63) that "In all the Aleutian Islands there are only two stands of trees--small groves of Sitka spruce (Picea sitchensis) on Amaknak and Expedition Islands in Unalaska Harbor. The trees were planted over a century ago and have as yet reached only a moderate size." Walker also remarked that "The failure of young trees to survive under the small groves of Sitka spruce near Unalaska mentioned before may be due to the raids of domestic animals, especially sheep or goats."

Bruce and Court (1945) discussed the theories as to the treelessness of the Aleutians and the tree planting carried out at the Army posts in the Aleutians during World War II. They noted that "In 1805 the Russians transplanted trees from Sitka to Unalaska (Dutch Harbor) and repeated the job at intervals, some of the trees are still there, but they have not spread." Summarizing the planting done in the Aleutians up to 1940, they wrote: "Of all these plantings, the most successful were those at Dutch Harbor, where there are 85 trees 20 to 35 feet tall and a dozen smaller ones, all spruce."

Robinson (1948) wrote that "Another Aleutian mystery, probably only remotely related to the volcanoes, is the nearly complete absence of trees." He noted that "Two small groves of Sitka spruce planted on Amaknak and Expedition Islands in Unalaska Bay more than 100 years ago have survived but not flourished;"

The literature shows that the first attempt at tree planting in the Aleutian Islands was made in 1805. The planting seems to have been inspired by the Russian Chamberlain Rezanov. Sitka spruce trees, 2-3 years old, from Sitka were planted on Amaknak Island, in Unalaska Bay. The original number of trees planted is unknown but Veniaminov reported that there were 24 alive in 1834, 29 years after establishment. Reports on the appearance and condition of the trees have appeared in the literature from time to time over a span of about a century and a half. The first report, by von Chamisso, concerned their condition some 10 to 13 years after planting. Probably no other plantation of trees in North America has received so much attention from so many observers from so many different parts of the world.

PRESENT CONDITION OF SITKA SPRUCE PLANTED IN 1805

In 1958, when observed by officials of the Bureau of Land Management, U. S. Department of the Interior, there were ten trees still standing, six alive and four dead. In addition, there were several dead trees on the ground, killed by fire in an adjacent building. The appearance of the standing trees is shown in figure 3.



Figure 3.--The 1805 planting of Sitka spruce on Amaknak Island as it appeared in 1958. Courtesy the Bureau of Land Management, U. S. Department of the Interior.

Earlier photographs (Adams 1903, Cantwell 1904, Tatewaki and Kobayashi 1934, and Hutchinson 1942b) all showed a small pond in the foreground. The pond disappeared when it was filled with gravel in the development of a military installation. This fill evidently backed water up and may have led to death of four of the trees still standing.

All the trees are scarred and heavily pruned. They have very rapid taper. From left to right in figure 3 the trees are as follows:

<u>Diameter at breast height</u> (Inches)	<u>Total height</u> (Feet)	<u>Crown radius</u> (Feet)	<u>Height to first live branches</u> (Feet)	<u>Remarks</u>
24.2) 23.0)	27	11	9	Forked at 4 ft.
14.0	24	18	10	Pruned, thrifty
27.2	26	13	10	Forked at 4.5 ft.
18.5	24			Dead
15.5	24			Dead
11.0	24			Dead
23.3	28	15	11	Pruned to 8 ft.; dying
18.2	27	11.5	11	Heavily pruned; dying
15.5	24			
18.2	27	13	7	Dead; obscured by tree in front

The trees are producing viable seed as is shown by the occurrence of numerous seedlings, averaging about 5 inches in height, that have become established on the exposed mineral soil of the gravel fill. Seedlings are found to a distance of 300 feet, or more, out from the trees. This is significant for it demonstrates that the planted trees can reproduce when favorable seedbed conditions are provided.

At least two other groups of Sitka spruce, representing plantings later than 1805 (presumably resulting from the efforts of the Russian priest, Veniaminov) occur at Unalaska. One of these is located in Lot 1, Block 10, of the Unalaska Townsite. There are six trees in the group (fig. 4). The average diameter at breast height is 12.3 inches; average total height, 19 feet; average crown radius, 10 feet; and average height to the first live branches, 4 feet. There are 53 trees (six of which are dead) near the military sub-base across a small lagoon south of Dutch Harbor on Amaknak Island. Diameters at breast height range from 3.5 inches to 19.2 inches.



Figure 4.--Sitka spruce in Lot 1, Block 10 of the Unalaska Townsite as they appeared in 1958. Presumably these trees were planted by the Russian priest Veniaminov sometime between 1834 and 1841. Courtesy of the Bureau of Land Management, U. S. Department of the Interior.

VIEWS ON CAUSES OF TREELESSNESS OF ALEUTIAN ISLANDS AND BASE OF THE ALASKA PENINSULA

Why the Aleutian Islands and base of the Alaska Peninsula are treeless must await further ecological studies. However, the opinions already advanced for this condition are of interest.

Steller, in 1741 (Golder 1925) in suggesting an explanation for the absence of trees in the Aleutians made a point that

In addition, all [the islands] have the peculiarity that they are very long and at the same time their breadth is quite out of proportion, for example: Shumagin's Island [now Nagai Island] is from twenty to thirty versts long [and] two to three broad, Bering's Island is thirty miles long and only four, or at most seven, versts broad. All the islands, of which we noticed seven between here and Bering's Island, were quite similarly formed. From this it follows that, as they lie exposed to the north and south and consequently suffer the most rapid changes of heat and cold and on account of such a slight breadth are moreover swept freely by the exceedingly severe storms of these regions, neither tree nor shrub can grow or get rooted.

A footnote by the late Alfred H. Brooks, at the end of the above passage, reads "Steller is probably right in his theory that the lack of shelter from severe winds accounts for the absence of timber on narrow islands whose axes are parallel to the prevailing high winds."

Lutké (1835) expressed the view that neither the climate nor the soil opposed tree growth on the Aleutian Islands and suggested that the complete lack of forests was to be explained by their destruction as a result of volcanic eruptions.

Veniaminov (1840) thought that the lack of forests in the Aleutians was worthy of study by scientists. He observed that some persons thought that the cause for lack of trees was violent and incessant winds. Veniaminov did not accept this explanation, however, and suggested rather that one of the main causes was the geological newness of the islands; being isolated from the timbered regions to the east by ocean waters, sufficient time had not yet passed for them to have received seeds of trees except willows and alders.

An anonymous writer in 1841, recording the tree-planting instructions supplied by O. B. Fisher to Veniaminov, also observed that the whole Aleutian chain was of volcanic origin and so new that it was never forested. It was further stated that neither temperature extremes, nor the small number of days with sunshine, nor any property of the soil, nor the severity of storms could prevent the growth of forests.

Lowe (1842), in a review of Veniaminov's report, observed that some students of natural science attributed the lack of trees in the Aleutians to the strong winds that prevail at all times of the year.

Ritter (1862) reporting on an inspection trip to the Russian Colonies in American by Golowin in 1860, expressed the view that the climate in the Aleutians was unfavorable, rain and cloudy weather being usual and clear days few. Ritter viewed the 1805 planting at Unalaska Island as a failure; he attributed the alleged failure not to climate but to poor execution of the project by inexperienced people.

Fernow (1902, p. 70), who visited the Alaska Peninsula and Aleutian Islands in 1899 as a member of the Harriman Alaska Expedition, considered the causes for the lack of trees. He wrote:

Mr. Gannett [1901, p. 272] wonders why the Island of Kadiak and the Alaskan Peninsula farther west and the Aleutian Islands are treeless. 'The rainfall,' he says, 'is ample, and the climate little more severe than at Sitka, less severe than about Prince William Sound. The suggestion that high, cold winds prevent tree growth is negatived by the fact that such winds occur all along the coast, in forested as well as nonforested parts.'

While an explanation of this forestless condition cannot, to be sure, be established with absolute certainty, the student of plant distribution finds, nevertheless, quite plausible explanations warranted by a closer study of the situation; and in this the winds play a role, not because they are severe and cold but because of their direction. The Alaska Peninsula and the Aleutian Islands show evidence that they are of recent volcanic origin. A forest could come to them only from the east or northeast, by the gradual extension of the coast forest. To secure this extension it is necessary that the winds should blow from the north and east from September to May, when the spruce and hemlock release their seed, and it should be dry in order to permit the cones to do so. The contrary usually happens: there is during these months a constant succession of southeast and south winds and the air is heavily charged with moisture. For this reason the spread of the forests is at least retarded, and only when, as may occasionally happen in many decades, when favorable wind direction at the right time coincides with a seed year, is progress possible. A most interesting example of the wandering of the spruce in recent times is found near Kadiak.

That trees can at least live much farther west than Kadiak Island is proved by a grove of spruces planted by a Russian priest many years ago at Unalaska, 500 miles to the westward. These trees, to be sure, do not show that they like the climate; and after all, if the character of the western and northern winds which strike this part of the Alaska extension were more fully studied, it would be found that they are different as regards temperature and moisture from those which have traveled over the Gulf of Alaska. Even on Kadiak Island the open groves are found only in protected coves and valleys.

Osgood (1904) made a reconnaissance of the base of the Alaska Peninsula in 1902. His views on the causes of the lack of conifer trees over much of the region are of interest. Osgood wrote, (pp. 23-24):

The coniferous trees themselves are doubtless in the same manner restricted in their general range by temperature, but along their extreme limits other factors must have considerable effect upon them. This is particularly true in the Alaska Peninsula region where the limit is a southern rather than a northern one. Just what are all the causes determining the nonexistence of coniferous trees on the greater part of the peninsula can hardly be ascertained until more work is done. Possibly one of the most effective checks to the extension of timber southward is the prevalence of wind and storm regardless of temperature. The topography and situation of the peninsula are most favorable for storm weather. Being long and narrow, with a ridge of high mountains extending throughout its length, and situated as it is between Bering Sea and the North Pacific Ocean, it must necessarily receive at nearly all seasons the force of many atmospheric disturbances. In the fall, it is swept by fierce winds, whether the temperature be moderate or not. Such conditions would restrict arborescent vegetation in almost any latitude. It is possible that, in spite of these adverse circumstances, the timber may be advancing along the peninsula and that it may ultimately extend much farther than now.

Griggs (1934) has shown that on Kodiak Island, at least, the forest is actually advancing. The advance is a long-term secular migration into new territory and not a phase of a cyclic oscillation back and forth.

Martin and Katz (1912, p. 19-20) reviewed several explanations that had previously been offered to account for the limits of forest vegetation in the lowlands of southwestern Alaska. They reported that

The observations of the Geological Survey party in 1909 show that there is no essential difference between the forested and non-forested areas in rainfall, temperature, intensity of winds, or in rocks and soils. They also support the conclusions of Fernow and Osgood that the forests are now advancing into treeless areas. The evidence for this lies chiefly in the scarcity of old dead trees throughout most of the forest areas and their complete absence on the margins of the forests. The earlier geologic explanation by assumed elevation following a period of submergence must be discarded, for proof of these recent movements is not at hand.

Walker discussed the vegetation of the Aleutians and observed that the lack of forest growth was not entirely understood (Collins et al. 1945). He wrote:

The severe winds and storms and the low light intensity due to the abundance of fog have been considered as possible causes, but the arguments in their favor are not very satisfactory. There seems more evidence to support the belief that the forests which may have existed in the Aleutians before the glacial period and were completely destroyed by the ice caps that existed on each island have not as yet had time to reestablish themselves. The forest on the Alaskan mainland is advancing westward, its course not barred by an inhospitable climate.

Hrdlička (1945, p. 16) ventured the thought that "... the soil probably lacks the right microorganisms, rather than, or besides, minerals for such vegetation."

Bruce and Court (1945) observed that "The reasons advanced for the lack of forest fall into two categories: either the present climate is too severe, or the trees have not yet spread so far since the last ice age." These authors examined available weather statistics for a clue to possible limiting factors. Precipitation seems adequate with 20 to 70 inches annually (most at the ends of the Aleutian chain, least in the middle). The growing season (from the last killing frost in the spring to the first frost in the fall) ranges from 130 to 190 days; this is far longer than in many other heavily forested regions in Alaska. Many students of forest geography at high latitudes regard a minimum of four months with a mean temperature above 50°F. as essential for forest growth. Bruce and Court observed that "At none of the Aleutian Islands is the mean temperature for any month more than 55°, nor is it above 50° in more than one or two months (July and

August)." At points such as Kodiak and Cordova, where natural forest occurs, the mean temperature during the summer months (June-September) is above 50°F. It is suggested by Bruce and Court that the relatively low summer temperatures in the Aleutians may be critical. With respect to number of days with sunshine, it appears that the treeless Aleutians enjoy as many, or as few, as heavily timbered southeastern Alaska. Winds are often severe in the Aleutians but so also are they severe in forested parts of Kodiak Island. Bruce and Court reported that "Analysis of 27 soil samples from seven representative Aleutian Islands by the Washington State College of Agriculture resulted in the conclusion that the soils are not too acid for successful tree growth. They are low in available nitrogen, phosphorus, and potassium as well as in readily soluble calcium, but not sufficiently so to be 'limiting factors for tree growth'."

To summarize, several writers have advanced the view that the Aleutian Islands and the westward portion of the Alaska Peninsula are treeless because of unfavorable climatic conditions. Severe winds and unfavorably low temperatures during the growing season are the climatic elements most commonly regarded as limiting factors. Other authors suggest that the absence of trees is to be explained by the newness of the land areas involved and their isolation from sources of tree seed. In other words, sufficient time has not elapsed for trees to reach the westward parts of the Alaska Peninsula and the Aleutian Islands. In support of this view is the fact that trees are now advancing into previously treeless areas on the Alaska Peninsula and on Kodiak Island.

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